Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Modifications of Parts 2 and 15 of the Commission's Rules for unlicensed devices and equipment approval	)	ET Docket No. 03-201
	)	
	)	

SECOND REPORT AND ORDER

Adopted: April 17,2007 Released: April 23,2007

By the Commission:

I. INTRODUCTION

1. By this action, we amend our rules to provide for more efficient equipment authorization of both existing modular transmitter devices and emerging partitioned (or "split") modular transmitter devices. These rule changes will benefit manufacturers by allowing greater flexibility in certifying equipment and providing relief from the need to obtain a new equipment authorization each time the same transmitter is installed in a different final product. The rule changes will also enable manufacturers to develop more flexible and more advanced unlicensed transmitter technologies. We further find that modular transmitter devices authorized in accordance with the revised equipment authorization procedures will not pose any increased risk of interference to other radio operations.

II. BACKGROUND

2. Part 15 of the Commission's rules governs the operation of unlicensed radio-frequency devices. As a general condition of operation. Part 15 devices may not cause harmful interference to authorized radio services and must accept any interference that they receive.[1] In recent years, there has been a significant increase in the number and types of devices operating under the Part 15 rules. Examples of common Part 15 devices include cordless phones, computers, wireless baby monitors, and garage door openers. Such devices are widely used in everyday consumer functions. Moreover, the rapid growth of devices that follow industry standards, such as IEEE 802.11 and Bluetooth, promise to further increase both the number and variety of devices that will operate on an unlicensed basis. Overall, the Part 15 rules have been highly successful in fostering the development of new unlicensed devices while protecting authorized users of the radio spectrum from harmful interference. Millions of Part 15 devices operate within the current rules without any significant interference issues.

3. In recent years, manufacturers have developed Part 15 transmitter modules (or ''single" modules) that can be incorporated into many different devices. These modules generally consist of a completely self-contained radio-frequency transmitter (transmission system) missing only an input signal source and a power source to make it functional. Once the modules are authorized by the Commission under its certification procedure, they may be incorporated into a number of host devices such as personal computers (PCs) or personal digital assistants (PDAs), which have been separately authorized.[2] The

[1] 47 C.F.R. § 15.5

[2] The Commission's equipment certification procedure is set forth in Sections 2.907, 2.927, 2.931, and Sections 2.1031 through 2.1060, 47 C.F.R. §§ 2.907, 2.927, 2.931 and 2.1031-2.1060.

completed product generally is not subject to requirements for further certification by the Commission. Therefore, modular transmitters save manufacturers the time and any related expenses that would be incurred if a new equipment authorization were needed for the same transmitter when it is installed in a new device.

4. This efficiency is a result of the June 26, 2000 ***Public Notice*** which the Commission released in response to manufacturers' request for guidance about the conditions under which approvals for Part 15 modular transmitters may be granted.' The ***Public Notice*** detailed eight criteria that must be met in order for the Commission to grant certification for modular transmitters. The ***Public Notice*** only addressed devices where all of the radio frequency components were contained completely within the module itself.

5. A new class of "split" modular devices is now under development.[4] These transmitters consist of two basic components: the "radio front end" or radio elements and the "firmware" or hardware on which the software that controls the radio operation resides. The radio front end and firmware can each be self-contained units. In split modular devices the radio front end is generally a stand-alone unit, while the firmware may either be a stand-alone unit or may be collocated within a device on a host system. A further partitioning is also possible by removing the local oscillator and tuning capacitors of the antenna from the radio front end. The separation of modular devices into these components will provide manufacturers the flexibility to design a larger variety of modular systems by mixing and matching individual components.

6. On September 10, 2003, the Commission adopted a ***Notice of Proposed Rulemaking (Notice)*** in which it, ***inter alia,*** proposed to clarify the equipment authorization requirements for modular transmitters? Sixteen parties filed comments in response to the ***Notice's*** proposals for **Part** 15 unlicensed transmitter module approvals. These parties **are** listed in Appendix C.

III. DISCUSSION

7. In this Second Report and Order we codify the ***Public Notice*** requirements for approving modular transmitters, with certain modifications. We also adopt requirements for the approval of split module transmitters, including a requirement that only parts of a split module that have been approved in **a** single application for equipment authorization may operate together. Further, we allow manufacturers the flexibility to demonstrate alternative methods in the application for equipment authorization to ensure that a modular transmitter will meet all the applicable **Part** 15 requirements under the operating conditions in which it will be used. We find that the increased flexibility adopted herein will facilitate the approval process for modular transmitters and provide relief from the need to obtain a new equipment authorization each time the same transmitter is installed in a different final product, and will promote an increase in the development of Part 15 devices without increasing the potential for interference to authorized radio services.

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[3] ***See Public Nofice,*** DA 00-1407.

[4] ***See, e.g.***, Ed Liu ex parte filed June 6,2005 and Intel ex parte filed May 2, 2005

[5] ***See Public Norice,*** Part 15 Unlicensed Modular Transmitter Approval, DA 00-1407, released June 26,2000 ***(Public Notice). See also, Modification of Pans 2 and 15 of the Commission's Rules for unlicensed devices and equipment approval,*** ET Docket No. 03-201, ***Notice of Proposed Rulemaking (Nofice),*** 18 FCC Rcd 18910 (2003). The Commission addressed the other proposals from the ***Norice,*** except for modular transmitters, in the ***Report and Order*** adopted in this proceeding on July 18,2004, stating that it would address this matter in a later action. ***See Modijication of Pan 2 and 15 of the Commission's Rules for unlicensed devices and equipment approval,*** ET Docket No. 03-201, ***Report and Order,*** 19 FCC Rcd 13539(2004).

A. Single Unit Modular Transmitters

8. Proposal. In the Notice, the Commission proposed to codify the criteria for approving modular transmitters contained in the *Public* Notice[6] The eight detailed criteria as documented in the 2000 Public Notice are as follows:

1. The modular transmitter must have its own RF shielding. This is intended to ensure that the module does not have to rely upon the shielding provided by the device into which it is installed in order for all modular transmitter emissions to comply with Part 15 limits. It is also intended to prevent coupling between the RF circuitry of the module and any wires or circuits in the device into which the module is installed. Such coupling may result in non-compliant operation.

2. The modular transmitter must have buffered modulation/data inputs (if such inputs are provided) to ensure that the module will comply with Part 15 requirements under conditions of excessive data rates or over-modulation.

3. The modular transmitter must have its own power supply regulation. This is intended to ensure that the module will comply with Part 15 requirements regardless of the design of the power supplying circuitry in the device into which the module is installed.

4. The modular transmitter must comply with the antenna requirements of Section 15.203 and 15.204(c). The antenna must either be permanently attached or employ a "unique" antenna coupler (at all connections between the module and the antenna, including the cable). Any antenna used with the module must be approved with the module, either at the time of initial authorization or through a Class II permissive change. The "professional installation" provision of Section 15.203 may not be applied to modules.

5. The modular transmitter must be tested in a stand-alone configuration, *i.e.*, the module must not be inside another device during testing. This is intended to demonstrate that the module is capable of complying with Part 15 emission limits regardless of the device into which it is eventually installed. Unless the transmitter module will be battery powered, it must comply with the AC line conducted requirements found in Section 15.207. AC or DC power lines and data input/output lines connected to the module must not contain fenites, unless they will be marketed with the module (see Section 15.27(a)). The length of these lines shall be a length typical of actual use or, if that length is unknown, at least 10 centimeters to ensure that there is no coupling between the case of the module and any supporting equipment. Any accessories, peripherals, or support equipment connected to the module during testing shall be unmodified or commercially available (see Section 15.31(i)).

6. The modular transmitter must be labeled with its own FCC ID number, and, if the FCC ID is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: "Contains Transmitter Module FCC ID: XYZMODELI" or "Contains FCC ID: XYZMODELI ." Any similar wording that expresses the same meaning may be used. The grantee may either provide such a label, an example of which must be included in the application for equipment authorization, or must provide adequate instructions along with the module which explain this requirement. In the latter case, a copy of these instructions must be

[6] See Notice at 18920

included in the application *for* equipment authorization

7. The modular transmitter must comply with any specific rule or operating requirements applicable to the transmitter and the manufacturer must provide adequate instructions along with the module to explain any such requirements. A copy of these instructions must be included in the application for equipment authorization. For example, there are very strict operational and timing requirements that must be met before a transmitter is authorized for operation under Section 15.231. For instance, data transmission is prohibited, except for operation under Section 15.231(e), in which case there are separate field strength level and timing requirements. Compliance with these requirements must be assured.

8. The modular transmitter must comply with any applicable RF exposure requirements. For example, FCC Rules in Sections 2.1091, 2.1093 and specific Sections of Part **15,** including **15.319(i), 15.407(f), 15.253(f),** 15.255(g) and 15.257(g) require that applicants for authorization of Unlicensed PCS, U-NII and millimeter wave devices perform a routine environmental evaluation for RF exposure to demonstrate compliance. In addition, applicants for authorization of spread spectrum transmitters operating under Section 15.247 are required to address RF exposure compliance in accordance with Section 15.247(i). Applicants for authorization of modular transmitters approved under other Sections of Part 15, when necessary, may also need to address certain RF exposure concerns, typically by providing specific installation and operating instructions for users, installer and other interested parties to ensure compliance.

9. Additionally, the Commission proposed to modify certain requirements to accommodate new split module transmitters in which the antenna, radio front end, and firmware are independent of one another? The Commission stated that it would appear to be appropriate to update the agency's practices for approving modular transmitten to accommodate both existing modular devices and emerging split modular devices (consisting of the firmware, radio front end, local oscillator and tuning capacitors, and antenna), so long as they meet certain guidelines. In this section we discuss the general approval requirements for modular transmitters. The additional specific approval requirements for split modular transmitters are addressed below.

10. ***Comments.*** Commenters generally agree with the Commission's proposal to codify the eight criteria for approving modular transmitters that contain all components within the module itself! However, some commenters suggest clarifications, raise concern about requirements which they believe are unnecessary and overly burdensome, and recommend ways to increase flexibility. Itron believes that the proposal does not include a clear definition for the term "modular transmitter'' and states that such a definition should be provided to avoid abuse of the modular approval process.[9] A number of parties suggest that the proposed rules be modified to provide more flexibility in meeting our equipment authorization requirements. In this regard, several commenters contend that the proposed rules on buffered modulation/data input, power supply regulation, and antenna requirements are unnecessary. Assa Abloy ITG believes that shielding, modulation buffering, and power supply regulation requirements are unnecessary for inductive radiators operating at 125 kHz and 13.56 MHz. It contends that no shielding is necessary, provided both radiated and conducted emissions meet Part 15 intentional radiator requirements as a stand-alone module; modulation buffering does not apply due to slow data rates and

[7] *See Notice* at **18921,18922.** Specifically, the Commission proposed to modify the first, second, and fifth criteria and add a ninth criteria for split module transmitters.

[8] **See,** ***e.g.***, Intel comments at **2** and **Wi-Fi** Alliance comments at 6.

[9] Itron comments at 7.

AM modulation always being less than 100%; and power supply regulation is not necessary because either regulated DC power is provided or the voltage is set in a range that would meet FCC requirements for the stand-alone module." Assa Abloy ITG also states that greater flexibility in antenna use should be provided for modular inductive transmitters in meeting the Part 15 certification requirements." Cisco states that the buffering criterion is redundant and could cause unneeded duplication in the design of modular devices because they either do not need buffers or already have buffers designed into the chips.[12] Instead of a modular transmitter being required to have its own power supply regulation, Cisco contends that the modular device be required to operate only at a supply voltage used for its authorization." While Globespan agrees with the intent of the power supply regulation, it states that not every section or component of the module needs power regulation and therefore, the requirement should be modified to reflect the exclusion of such components.[14] In addition, Globespan, Cisco and Nortel Networks comment that antenna flexibility should be allowed for modular transmitters. [15] Intel and Nortel Networks state that electronic labeling should be accepted for labeling a transmitter module and labeling the unit with the various modules that it may contain, with the capability of electronically querying information on a module in a particular unit, respectively.[16] Globespan suggests modifying the proposed rules to make the host device manufacturer responsible for meeting the requirements specified in the modular transmitter authorization.[17]

11. ***Decision.*** We are codifying the proposed requirements for approving single modular transmitters into the rules with the modifications described below. This action will ensure that all equipment manufacturers are provided with adequate notice of the Commission's requirements for obtaining modular transmitter approvals. As requested by Itron, we are adopting a definition for a modular transmitter. Specifically, a modular transmitter will be defined as a completely self-contained radio-frequency transmitter device that is typically incorporated into another product, host or device. However, we will not require "module-like devices" that contain Part 15 transmitters to be approved as modular transmitters." Consistent with current Commission policy, we will continue to permit such devices to be approved as stand-alone transmitters under the present authorization procedures, although manufacturers may obtain approval for them as modules if they desire.

12. Although the Commission did not, in the ***Notice***, propose alternative methods by which manufacturers could meet the modular transmitter approval requirements, we agree with commenters that more flexibility should be offered to meet such requirements. Based on our experience in approving transmitter modules over the last seven years, we find that the approval criteria in the ***Public Notice*** are

[10] Assa Abloy ITG comments at 1.

[11] Assa Ahloy ITG comments at 1-2.

[12] Cisco comments at **13.**

[13] Cisco comments at 12-13

[14] Globespan comments at 7.

[15] Globespan comments at 7 (Commission should apply general antenna rules and manufacturers must provide list of acceptable antennas with application and as part of instructions), Cisco comments at 13 (Commission should either remove antenna criterion or clarify that flexible multiple antenna rules applies to transmitter modules), and Nortel Networks comments at 13 (There should be no restriction on the use of connector types).

[16] Intel comments at 3 and Nortel Networks comments at **13**

[17] Globespan comments at 8.

[18] Module-like transmitters are peripheral to a host and are typically plugged into an externally accessible standard bus on such hosts. Examples of such industry defined standard bus interfaces are PCMCIA (PC Card), SDIO or CompactFlash slots on laptop computers or PDAs. Module-like transmitters demonstrate compliance to the applicable rules by being tested in appropriate host platform configurations.

appropriate in most cases. However, we recognize that there may be circumstances where there are alternative means that will enable a modular transmitter to meet all applicable Part 15 requirements under the operating conditions in which the transmitter will be used. Therefore, we are adopting a rule that states that modular transmitters do not have to comply with all of the approval requirements if the manufacturer can demonstrate by alternative means in the application for equipment authorization that the equipment complies with the Part 15 rules. Specifically, we will permit manufacturers flexibility with respect to the requirements such as module shielding," buffered modulation/data inputs and power supply regulation, because compliance with these requirements may not be necessary in specific module installations. Consistent with the Public Notice, the Commission may grant a "Limited Modular Approval" in instances where the equipment does not meet all eight criteria for modular transmitters, but the grantee of equipment authorization can demonstrate that it will retain control over the final installation of the device such that compliance of the end product is assured. In such cases, the grantee must state how control of the end product into which the module will be installed will be maintained such that full compliance of the end product is always ensured?' A limited modular approval is subject to conditions such as the device(s) into which the module can be installed, the antenna separation distance from persons or the locations where it may be used (*e.g.*, outdoor only).

13. To provide additional flexibility to manufacturers and to parties incorporating modular transmitters into other devices, we will permit electronic labeling of modular transmitters in the same manner as we allow for software defined radios.*' The FCC identification number may be shown on an electronic display on the module itself if the module contains a display that is visible to the user, or more typically, it may be displayed on the device into which the module is installed, such as a laptop computer or PDA. The information must be readily accessible, and the user manual must describe how to access the electronic display. In addition to the electronic display, we will require a simple label on the product indicating when a module is installed inside a host device to facilitate identification of equipment that contains modular transmitters. This approach will simplify the labeling procedure for parties that incorporate modules into other devices because they will not need to affix a different label on the outside of a device for each type of modular transmitter that may be installed inside.

14. We decline to make changes to the antenna connector requirements for modular transmitters The Commission previously addressed this issue in the Report and Order in this proceeding?' We note, however, that the changes adopted in the Report and Order that allow intentional radiators to be authorized with multiple antenna types similarly apply to modular transmitters.

15. We decline to modify the rules to state that the host device manufacturer is responsible for meeting the requirements specified in the modular transmitter authorization.*' It is ultimately the responsibility of the grantee of equipment authorization to comply with the terms of the equipment authorization.[24] We note, however, that in the case of equipment requiring special accessories, the rules

[19] Consistent with the rules we are adopting below for split modular transmitters. we will permit manufacturers to locate the physical crystal and tuning capacitors external to the shielded radio elements of single unit modular transmitters.

[20] Limited modular approval also may be granted in those instances where compliance with RF exposure rules is demonstrated only for particular product configurations.

[21] See 47 C.F.R. § 2.925(e).

[22] *See* Report *and Order* at paragraph 23. In the *Report and* Order, the Commission maintained that an intentional radiator must use a unique antenna connector, while also permitting such devices to be authorized to allow use with multiple antennas having similar in and out-of-hand gain and radiation pattern.

[23] Glohespan comments at 8.

[24] *See* 47 C.F.R. § 2.931.

state that it is the responsibility of the user to use the needed special accessories that the grantee is required to supply with the equipment?' We also note that some parties are assembling devices that contain multiple approved modules that may interact with each other and may cause the host device to operate out of compliance with the Commission's rules.[26] In this case, the assembler is responsible for any interactions that cause the device to operate out of compliance with the Commission's rules, while the grantee of the equipment authorization for each module remains responsible for the compliance of the module with the equipment authorization. If an assembler makes any changes to an approved module, it becomes the patty responsible for compliance of that module and must obtain a new equipment authorization.[27]

B. Split Modular Transmitters

16. As noted above. a new class of split modular transmitters is now under development. These transmitters consist of two basic components: the radio front end and the firmware on which the software that controls the radio operation resides. The separation of modular devices into these components will provide manufacturers with flexibility to design a larger variety of modular systems by mixing and matching individual components.

17. ***Proposal.*** The ***Public Notice*** on modular transmitter approvals envisioned that a transmitter module would be a single component device, rather than split into two separate sections. Certain requirements in the ***Public Notice*** may not be appropriate or may be unnecessarily restrictive for split modules. Therefore, in the ***Notice,*** the Commission proposed to modify the requirements for shielding, control information, and test procedures in the ***Public Notice*** to accommodate the special case of new split modules io which the antenna, radio front end, and firmware are. independent of one another.

18. The Commission proposed to clarify that only the radio front end of a split modular unit must be shielded.[28] All components that require shielding would be required to be inside this unit. The other sections of the modular unit, the firmware that will be either part of another device or sit "stand-alone" on a platform and an antenna to complete the system, would not be required to be shielded. Also, the Commission proposed to allow the physical crystal and tuning capacitors to be located externally of the shielded radio front end. Additionally, the Commission proposed to require that the interface between the sections of the modular system be digital with a minimum signaling level of 150 mV peak-to-peak. The Commission sought comment on alternative methods of demonstrating compliance with the Part 15 rules herein, including: a) impulse interference testing similar to that used in EN61000-4-4;[29] b) using a two-tone interference test and coupling the interferers into the cabling; and c) looking at interference levels required to degrade the bit error rate to an acceptable level, (*i.e.*, typical interface hit error rates of 10^{-11}, degraded to 10^{-6}.

19. The Commission also proposed to allow control information and other data to cross the interface between the firmware and the radio front end." It stated that this change is necessary for split modules because control information (frequency, power, and radio operation) needs to be shared between

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[25] See 47 C.F.R. § 15.27(a).

[26] For example, a notebook computer may contain multiple transmitter modules that operate in different frequency bands (*e.g.*, 2.4 and 5 GHz) and/or that use different transmission standards (*e.g.*, Bluetooth and IEEE 802.11x).

[27] *See* 47 C.F.R. § 2.909(a).

[28] *See Notice* at 18921.

[29] See "IEC 61000-4-4, Electromagnetic Compatibility (EMD) – Pan 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test." Published by the International Electrotechnical Commission.

[30] ***See Notice*** at 18922.

the radio front end and firmware. Additionally, the Commission proposed to define a "reference platform" that the radio manufacturer would build for compliance testing." It proposed that, at a minimum, a reference platform would consist of the radio front end, antenna, and an "environment" such as a PDA or laptop on which the firmware will operate. Any future changes to the radio front end or firmware would require re-testing on the pre-approved reference platform. Signal injection testing would be done on the implementation with a maximum length of cabling connecting the modular components. The Commission sought comment on the design of a reference platform and the length and type of cable used to connect the components.

20. Further, the Commission proposed to add a ninth requirement specific to split modular transmitters that would provide that only a radio front end and firmware that have been certified together as a pair may operate with one another.[32] This requirement would ensure that consumers or third parties do not mix and match front ends and firmware in combinations that may result in operation that would not conform to the Part 15 rules. The Commission also proposed to require that manufacturers implement a unique digital key or "type number'' by which approved radio front ends and firmware would recognize each other. It tentatively proposed that the type number would consist of a digital word 4 bytes in length with the following bit definition: 16 bits for the company information, 16 bits for the device number. The Commission sought comment on the practicality of implementing such a requirement, as well as appropriate methods for implementing this form of device matching security for modular transmitters.

21. ***Comments.*** Commenters generally agree with the Commission's proposal to adopt a ninth criterion to accommodate the special case of split module transmitters?' In describing a split module, some commenters suggest use of a different term than "firmware" because this term is not consistent with industry use. The Joint Electron Device Engineering Council and Globespan recommend the term "digital radio controller" in place of "firmware."[34] Hewlett Packard and Wi-Fi Alliance recommend the term "transmitter control functionality," while Pegasus Technologies recommends "control element.""

22. Dell, Globespan, and Nortel Networks state that more flexibility should be provided for demonstrating compliance with the requirements for shielding and interface signal levels.[36] The Consumer Electronics Association states that the Commission should specify an interfering signal level and tests in addition to the minimum signal amplitude.[37] The Joint Electron Device Engineering Council states that if an external crystal and tuning capacitor is needed for operation of the module, the component types required to ensure compliance of the module should be specified by the manufacturer in the instructions for use of the module.[38]

23. Motorola agrees with the concept of specifying a reference platform for testing, while other commenters state that such a platform is unnecessary or that the plan proposed should be modified."' For example, Intel states that it is unnecessary to require that a fixed environment such as a PDA or laptop be used in retesting for future changes to the radio front end or firmware and instead believes that the only

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[31] *Id.*

[32] Id.

[33] *See, e.g.*, Information Technology Industry Council comments at 7 and Symbol Technologies comments at 3-4.

[34] Joint Electron Device Engineering Council comments at 2 and Globespan comments at 6.

[35] Hewlett Packard comments at 5 and Wi-Fi comments at 6.

[36] Dell comments at 2, Globespan comments at 10, and Nortel Networks comments at 13.

[37] Consumer Electron Association comments at 9.

[38] Joint Electron Device Engineering Council comments at 2-3.

[39] Motorola comments at 4-5.

requirement should be that the firmware runs unmodified in an implementation.[40] Also, Intel states that 30 centimeters would be a more realistic cable length for testing a split module an a reference platform than the proposed 10 centimeters.[41] Further, Joint Electron Device Engineering Council and Globespan suggest addition of more specific applications and guidelines for testing split modules, such as an interface interference testing method, number of tests required, cable lengths, and power supplies at limits of voltage and noise.[42]

24. Commenters support the use of an industry standard for device and type numbering.[43] The Consumer Electronics Association and Intel also submit that additional methods of security should be implemented for authentication.[44] The Consumer Electronics Association suggests using electronic handshaking to ensure that split modules operate only with a front end and firmware that have been certified together as a pair. Intel suggests that the host system authenticate the firmware and that the firmware validate that the front-end component has an approved type number for use with that firmware. Hewlett Packard, IEEE 802, and Wi-Fi Alliance recommend that the modular approval process be extended to allow for mix-and-match of module components from different manufacturers. [45]

25. ***Decision.*** We are adopting the modified and additional approval requirements for split modules described below. These rules will provide manufacturers relief from the need to obtain a new equipment authorization each time the same split modular transmitter is installed in a different device. Reducing the authorization burden for split modular transmitters will encourage and enable manufactures to develop more flexible and more advanced unlicensed transmitter technologies. We also find that, with appropriate safeguards as discussed below, split modules may be authorized while continuing to ensure that final products comply with the Commission's technical requirements.

26. We will use the term "transmitter control element" in place of the proposed term "firmware" for split modular transmitters. As commenting parties observe, the term firmware is generally used to describe computer instructions that are stored in a read-only memory. While that term may be appropriate for describing how transmitter functions are carried out in some split module implementations, it may not be appropriate in all cases. Thus, we are using the more generic term "transmitter control element".

27. For a split modular transmitter, there are three pieces that must be tested together. The first is the RF front end, which consists of the power amplifier, antenna, and possibly the circuitry that produces the modulation. The second piece is the transmitter control element, which may be on its own chip or circuit board, or which may consist of components incorporated into another device. The transmitter control element may produce the modulation rather than the RF front end. The third piece is the host device, such as a notebook computer or personal digital assistant, which will be used to link the first two pieces of the split module together. The Commission will use some judgment at the time of equipment authorization as to whether the host device with which a modular transmitter is tested is representative of the intended use(s) of that modular transmitter.

28. We are adopting the proposed requirements that only the radio front end of a split module must be shielded. We do not believe that it is necessary to shield the transmitter control element because

[40] Intel comments at 5.

[41] Intel comments at 5.

[42] Joint Electron Device Engineering Council comments at 4 and Globespan comments at 12-14.

[43] See, *e.g.*, Globespan comments at 15, Hewlett Packard comments at 5, and Wi-FI Alliance comments at 7.

[44] Consumer Electronics Association comments at 9 and Intel comments at 5.

[45] Hewlett Packard comments at 8. IEEE 802 comments at 6, and Wi-Fi Alliance comments at 7.

it is unlikely any stray RF energy to this circuitry would effect the emissions from the overall device. The rules we are adopting will allow the physical crystal and tuning capacitors to he located external to the shielded radio element. This approach recognizes that it would greatly complicate equipment design to shield the crystal and tuning capacitor and does not appear warranted by the negligible risk of any impact on the transmitter output. We are also adopting a requirement that the interface between sections of the split modular system must be digital with a minimum signaling amplitude of 150 millivolts peak-to-peak. These requirements will help ensure that the interface between sections of a split module is immune to stray signals that could cause the module to operate out of compliance with the Part 15 rules. While these requirements should be appropriate in most cases, we recognize the concerns of parties who request additional flexibility in meeting these requirements. Therefore, consistent with our actions for single modules, we will permit manufacturers to demonstrate alternatives to these requirements that will ensure that the split modular transmitter complies with the Part 15 rules.

29. We are adopting a rule stating that control information and other data may be exchanged between the radio front end and transmitter control elements. The purpose of this rule is merely to clarify that in a split module, data may be sent not to just the module input as in a single module, but also between sections of the module.

30. We decline to define a reference platform or specific cable lengths for testing split modules as proposed in the *Notice*. Because split modules are a new technology, we conclude that it would be premature for us to specify detailed testing procedures that may not be applicable to all implementations and could inadvertently hinder development of this technology. Rather, we will require manufacturers to comply with the basic objective of demonstrating, through testing, that their split module equipment will comply with the applicable Part 15 requirements (*e.g.*, frequency, power, spurious emissions limits, and other rules). We will provide manufacturers with the flexibility to perform testing on a platform that is representative of actual use, such as a laptop or PDA, but may require a manufacturer to perform testing on additional platforms if necessary to demonstrate that the equipment will comply under the conditions in which it will be used. The sections of a split module must be tested together as a system and will be authorized as a system with a single FCC identification number.[46]

31. We decline to require a standard physical or logical interface between sections of a split module or to require the use of an industry standard. We now find that such an action could hinder development of this nascent technology. Manufacturers are free to develop standard interfaces and use industry standards in designing split modules at their discretion. Parties may also mix and match radio front ends and transmitter control elements made by different manufacturers in split modules, but to ensure the compliance of these components as a module they must be tested and certified as a system on a platform representative of actual use. Each combination of radio front end and transmitter control elements must have its own FCC identification number that will indicate which party is responsible for compliance of the system. We will not require a permanently affixed label on the transmitter control elements of a split module when electronic labeling is used, because the radio front end or transmitter control element may be integrated into another device, making physical labeling impractical. However, if electronic labeling is not used, we will require a permanently affixed label to be located either on the radio front end, transmitter control elements, or the host device.

32. Because split modules are tested for compliance and authorized as a system, we find that it is necessary to adopt requirements to ensure that only sections of a split module system that have been approved together may be used together in a device. Therefore, we are adopting a general security requirement for split modules that is similar to the security requirement for software defined radios that

[46] We will consider changes to either part of an approved split module consistent with the variations permitted under the permissive change rules. See 47 C.F.R. § 2.1043(b).

ensures that only hardware and software that has been approved together may operate in a device.[47] Specifically, we are requiring that manufacturers take steps to ensure that only transmitter control elements and radio front end components that have been approved together are capable of operating together. We are also requiring that the split module not operate unless it has verified that the installed transmitter control elements and radio front end have been authorized together. We will permit manufacturers to use means including, but not limited to, coding in hardware and electronic signatures in software to meet these requirements, and will require them to describe the methods for ensuring that components operate only when connected with other components included under the same equipment authorization in their application for equipment authorization.

33. We will not permit Telecommunication Certification Bodies (TCBs) to certify split modules at this time. Split modules are a new technology, and TCBs will not be permitted to certify them until the Commission has more experience with them and can properly advise TCBs on how to apply the applicable rules. The Commission's Laboratory maintains a list of types of devices that TCBs are excluded from certifying and will place split modules on this list until the Laboratory determines that TCBs are capable of certifying them.

IV. PROCEDURAL MATTERS

A. Final Regulatory Flexibility Analysis

34. The Final Regulatory Flexibility Analysis, required by the Regulatory Flexibility Act, see 5 U.S.C. § 604, is contained in Appendix B.

B. Final Paperwork Reduction Act of 1995 Analysis

35. This Second Report and Order contains new or modified information collections subject to the Paperwork Reduction Act of 1995 (PRA) and will be submitted to the Office of Management and Budget (OMB) for review under Section 3507(d) of the PRA, Public Law 104-13. A modification is required to the Form 731 (OMB 3060-0057).

C. Contact Persons

36. For additional information concerning this Second Report and Order, contact Hugh L. Van Tuyl at (202) 418-7506 or Shameeka Hunt at (202) 418-2062 or via the Internet at Hugh.VanTuyl@fcc.gov or Shameeka.Hunt@fcc.gov, respectively.

V. ORDERING CLAUSES

37. Accordingly, IT IS ORDERED that Part 15 of the Commission's Rules IS AMENDED as specified in Appendix A, effective 30 days after publication in the Federal Register. This Second Report and Order contains information collection requirements subject to the Paperwork Reduction Act of 1995 (PRA), Public Law 104-13, that are not effective until approved by the Office of Management and Budget. The Federal Communications Commission will publish a document in the Federal Register announcing the effective date of the rules. This action is taken pursuant to the authority contained in Sections 1, 4(i), 303(f), and 303(r) of the Communications act of 1934, as amended, 47 U.S.C. Sections 151, 154(i), 303(f), and 303(r).

[47] *See* 47 C.F.R. § 2.944(a).

38. IT IS FURTHER ORDERED that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, SHALL SEND a copy of the Second Report and Order. including the Final Regulatory Flexibility Analysis, to the Government accountability Office pursuant to the Congressional Review Act, see 5 U.S.C. 801(a)(1)(A).

FEDERAL COMMUNICATIONS COMMISSION

A—

Marlene H. Dortch

Secretary

APPENDIX A

Final Rules

Part 15 of Title 47 of the Code of Federal Regulations **is** amended as follows:

1. The authority citation of **Part** 15 continues to read as follows:

AUTHORITY: 47 U.S.C. 154, 302a, 303, 304, 307, 336, and **544A**

2. A new section 15.212 is added to read as follows:

§ 15.212 Modular **transmitters.**

(a) Single modular transmitters consist of a completely self-contained radiofrequency transmitter device that is typically incorporated into another product, host or device. Split modular transmitters consist of two components: a radio front end with antenna (or radio devices) and a transmitter control element (or specific hardware **on** which the software that controls the radio operation resides). All single or split modular transmitters are approved with an antenna. **All** of the following requirements apply, except as provided in paragraph (b) of this section.

(1) Single modular transmitters must meet the following requirements to obtain a modular transmitter approval.

(i) The radio elements of the modular transmitter must have their own shielding. The physical crystal and tuning capacitors may be located external to the shielded radio elements.

(ii) The modular transmitter must have buffered modulation/data inputs (if such inputs are provided) to ensure that the module will comply with Part IS requirements under conditions of excessive data rates or over-modulation.

(iii) The modular transmitter must have its own power supply regulation.

(iv) The modular transmitter must comply with the antenna and transmission system requirements of Sections 15.203, 15.204(b) and 15.204(c). The antenna must either be permanently attached or employ a "unique" antenna coupler (at all connections between the module and the antenna, including the cable). The "professional installation" provision of Section 15.203 is not applicable to modules but can apply to limited modular approvals under paragraph (b) of this section.

(v) The modular transmitter must be tested in a stand-alone configuration, *i.e.*, the module must not be inside another device during testing for compliance with Part 15 requirements. Unless the transmitter module will be battery powered, it must comply with the **AC** line conducted requirements found in Section 15.207. **AC** or DC power lines and data input/output lines connected to the module must not contain femtes, unless they will be marketed with the module (see Section 15.27(a)). The length of these lines shall be the length typical **of** actual use or, if that length is unknown, at least 10 centimeters to insure that there is no coupling between the case of the module and supporting equipment. Any accessories, peripherals, or support equipment connected to the module during testing shall be unmodified and commercially available (see Section 15.31(i)).

(vi) The modular transmitter must be **equipped** with either a permanently affixed label or must be capable of electronically displaying its FCC identification number.

(A) If using a permanently affixed label, the modular transmitter must be labeled with its own FCC identification number, and, if the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: "Contains Transmitter Module FCC ID: XYZMODELI" or "Contains FCC ID: XYZMODELI." Any similar wording that expresses the same meaning may be used. The Grantee may either provide such a label, an example of which must be included in the application for equipment authorization, or, must provide adequate instructions along with the module which explain this requirement. In the latter case, a copy of these instructions must be included in the application for equipment authorization.

(B) If the modular transmitter uses an electronic display of the FCC identification number, the information must be readily accessible and visible on the modular transmitter or on the device in which it is installed. If the module is installed inside another device, then the outside of the device into which the module is installed must display a label referring to the enclosed module. This exterior label can use wording such as the following: "Contains FCC certified transmitter module(s)." Any similar wording that expresses the same meaning may be used. The user manual must include instructions on how to access the electronic display. A copy of these instructions must be included in the application for equipment authorization.

(vii) The modular transmitter must comply with any specific rules or operating requirements that ordinarily apply to a complete transmitter and the manufacturer must provide adequate instructions along with the module to explain any such requirements. A copy of these instructions must be included in the application for equipment authorization.

(viii) The modular transmitter must comply with any applicable RF exposure requirements in its final configuration.

(2) Split modular transmitters must meet the requirements in paragraph (a)(1) of this section, excluding paragraphs (a)(1)(i) and (a)(1)(v), and the following additional requirements to obtain a modular transmitter approval.

(i) Only the radio front end must be shielded. The physical crystal and tuning capacitors may be located external to the shielded radio elements. The interface between the split sections of the modular system must be digital with a minimum signaling amplitude of 150 mV peak-to-peak.

(ii) Control information and other data may be exchanged between the transmitter control elements and radio front end.

(iii) The sections of a split modular transmitter must be tested installed in a host device(s) similar to that which is representative of the platform(s) intended for use.

(iv) Manufacturers must ensure that only transmitter control elements and radio front end components that have been approved together are capable of operating together. The transmitter module must not operate unless it has verified that the installed transmitter control elements and radio front end have been authorized together. Manufacturers may

use means including, but not limited to, coding in hardware and electronic signatures in software to meet these requirements, and must describe the methods in their application for equipment authorization.

(b) A limited modular approval may be granted for single or split modular transmitters that do not comply with all of the above requirements, *e.g.*, shielding, minimum signaling amplitude, buffered modulation/data inputs, or power supply regulation, if the manufacturer can demonstrate by alternative means in the application for equipment authorization that the modular transmitter meets all the applicable Part 15 requirements under the operating conditions in which the transmitter will be used. Limited modular approval also may be granted in those instances where compliance with RF exposure rules is demonstrated only for particular product configurations. The applicant for certification must state how control of the end product into which the module will be installed will be maintained such that full compliance of the end product is always ensured.

APPENDIX B

Supplemental Final Regulatory Flexibility Analysis

As required by the Regulatory Flexibility Act (RFA),[1] an Initial Regulatory Flexibility Analysis (IRFA) was incorporated in the ***Notice of Proposed Rulemaking (Notice)*** in this docket, ET Docket 03-**201.** The Commission sought written public comment on the proposals in the ***Norice,*** including comment on the IRFA. This present Supplemental Final Regulatory Flexibility Analysis (FRFA) conforms to the RFA.[2]

A. Need for, and Objectives of, the Second Report and Order

In recent years, manufacturers have developed Part 15 transmitter modules (or "single" modules) that can be incorporated into many different devices. A module generally consists of a completely self-contained radio-frequency transmitter missing only an input signal source and a power source to make it functional. Once a module is authorized by the Commission under its certification procedure, it may be incorporated into a number of host devices such as personal computers (PCs) or personal digital assistants (PDAs), which have been separately authorized. The completed product generally is not subject to requirements for further certification by the Commission. Therefore, modular transmitters save manufacturers the time and any related expenses that would be incurred if a new equipment authorization were needed for the same transmitter when it is installed in a new device.

On June **26,2000,** the Commission released a ***Public Notice*** detailing eight criteria that must be met in order for the Commission to grant certification to a Part 15 transmitter as a module. Specifically, the module must: 1) have its own radio-frequency shielding, **2)** have buffered modulation/data inputs to ensure that the device will comply with the Part 15 requirements with any type of input signal, 3) contain power supply regulation, **4)** comply with the Part 15 antenna requirements, 5) be tested in a stand-alone configuration, 6) be labeled with its own FCC ID, 7) comply with any specific rules applicable to the transmitter, and 8) comply with RF safety requirements. This ***Public Notice*** was released in response to manufacturers' requests to the FCC Laboratory for information about the conditions under which Part 15 modular transmitter approvals may be granted. In the ***Notice*** in this proceeding, the Commission proposed to codify the criteria from the ***Public Notice*** for approval of singular modular transmitters. In addition, the Commission proposed additional criteria that must be met for approval of split modular transmitters.

The Second Report and Order codifies the eight Public Notice requirements for approval of single modular transmitters. It also adopts specific requirements for the approval of split modular devices. Specifically, in a split modular device: 1) only the radio-frequency section of the module must be shielded, **2)** the two sections of the module may exchange data and control information, 3) the sections of a split module must be tested together in a representative device, and **4)** split modules must contain measures such a security codes to ensure that only sections of a module that have been approved together will function together in a host device. These rule changes will benefit manufacturers by allowing greater flexibility in certifying equipment and providing relief from the need to obtain a new equipment authorization each time the same transmitter is installed in a different device. The rule changes will also enable manufactures to develop more flexible and more advanced unlicensed transmitter technologies.

[1] **See 5 U.S.C. § 603.** The RFA, **see 5** U.S.C. **§ 601-612,** has been amended by the Small Business Regulatory Enforcement Fairness Act of **1996** (SBREFA), Pub. **L.** No. 104-121, Title **II,** 110 Stat. 857 **(1996).**

[2] ***See*** **5 U.S.C. 603,** Title **II,** 110 Stat **857 (1996).**

B. Summary of Significant Issues Raised by Public Comments in Response to the IRFA

No comments were filed in response to the IRFA

C. Description and Estimate of the Number of Small Entities to Which the Rules Will Apply

The RFA directs agencies to provide a description of, and, where feasible, an estimate of the number of small entities that may be affected by the proposed rules, if adopted.[3] The RFA defines the term "small entity" as having the same meaning as the terms "small business," "small organization," and "small business concern" under Section 3 of the Small Business Act.[4] Under the Small Business Act, a "small business concern" is one that: (1) is independently owned and operated; (2) is not dominant in its field of operations; and (3) meets additional criteria established by the Small Business Administration (SBA).[5]

The rules adopted in this Second Report and Order pertain to manufacturers of unlicensed communications devices. The appropriate small business size standard is that which the SBA has established for radio and television broadcasting and wireless communications equipment manufacturing. This category encompasses entities that primarily manufacture radio, television, and wireless communications equipment.[6] Under this standard, firms are considered small if they have 750 or fewer employees.[7] Census Bureau data for 1997 indicate that, for that year, there were a total of 1,215 establishments[8] in this category.[9] Of those, there were 1,150 that had employment under 500, and an additional 37 that had employment of 500 to 999. The percentage of wireless equipment manufacturers in this category is approximately 61.35%, so the Commission estimates that the number of wireless equipment manufacturers with employment under 500 was actually closer to 706, with an additional 23 establishments having employment of between 500 and 999. Given the above, the Commission estimates that the great majority of wireless communications equipment manufacturers are small businesses.

D. Description of Projected Reporting, Recordkeeping, and Other Compliance Requirements

Part 15 modular transmitters are already required to be certified before they can be legally imported into or marketed within the United States. The rule changes adopted in this proceeding will not alter any of the current reporting or recordkeeping requirements. Telecommunication Certification Bodies (TCBs) will not be permitted to certify split modular transmitters until the Commission has more experience with them and can properly advise TCBs on how to apply the applicable rules.

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[3] See U.S.C. § 603(b)(3).

[4] Id. § 601(3).

[5] Id. § 632.

[6] NAICS code 334220.

[7] Id.

[8] The number of "establishments" is a less helpful indicator of small business prevalence in this context than would be the number of "firms" or "companies," because the latter take into account the concept of common ownership or control. Any single physical location for an entity is an establishment, even though that location may be owned by a different establishment. Thus, the numbers given may reflect inflated numbers of businesses in this category, including the numbers of small businesses. In this category, the Census breaks-out data for firms or companies only to give the total number of such entities for 1997, which was 1,089.

[9] U.S. Census Bureau, 1997 Economic Census, Industry Series: Manufactunng. "Industry Statistics by Employment Size," Table 4, NAICS code 334220.

E. Steps Taken to Minimize Significant Economic Impact on Small Entities, and Significant Alternatives Considered

The RFA requires an agency to describe any significant alternatives that it has considered in reaching its approach, which may include the following four alternatives: (1) the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities: (2) the clarification, consolidation, or simplification of compliance and reporting requirements under the rule for such small entities; (3) the use of performance rather than design standards; and **(4)** an exemption from coverage of the rule, or any part thereof, for such small entities.

Modular approvals save manufacturers, both large and small, the burden of having to test a transmitter multiple times for incorporation into multiple host devices. However, we recognize that in some instances, particularly with respect to small manufacturers, the drawback to modular approvals is that the certification of a module is somewhat more burdensome because the manufacturer must show compliance with the eight requirements from the June 2000 public notice that the current item incorporates into the rules. This could mean that a manufacturer has to incorporate shielding, modulation buffering or power supply regulation to make a device eligible for a modular approval, or that it has to be tested in different configurations than non-modular transmitters.

Because smaller manufacturers may find that these requirements impose an economically significant burden, we have provided for two alternatives to reduce this burden.

First, the rules do not require that a manufacturer approve a transmitter as a module. If a transmitter is only intended to be installed in a small number of different devices, a manufacturer may find it is more efficient, either cost-wise or time-wise, to simply obtain a separate certification for each device.

Second, the rules permit "limited modular approvals" for transmitters that do not comply with all eight requirements for modular certification if the manufacturer can demonstrate by alternative means in the application for equipment authorization that the equipment will comply with the Part 15 rules. Specifically, manufacturers have flexibility with respect to requirements such as module shielding, buffered modulation/data inputs and power supply regulation, because compliance with these requirements may not be necessary in specific module installations. The manufacturer must demonstrate that it will retain control over the final installation of the device such that compliance of the end product is assured. A limited modular approval is subject to conditions such as the device(s) into which the module can be installed, a requirement for professional installation, the antenna separation distance from persons or the locations where it may be used (*e.g.*, outdoor only).

F. Report to Congress

The Commission will send a copy of the Second Report and Order, including this FRFA, in a report to be sent to Congress pursuant to the Congressional Review Act.[10] In addition, the Commission will send a copy of the second Report and Order, including the FRFA, to Congress and the Government Accountability Office.. A copy of the Second Report and Order and FRFA (or summaries thereof) will also be published in the Federal Register.[11]

[10] *See 5* U.S.C. § 801(a)(1)(A).

[11] *See 5* U.S.C. § 604(b).

APPENDIX C

List of Commenting Parties

1. Assa Abloy ITG, HID Corporation, Indala Corporation
2. Cisco Systems, Inc.
3. Consumer Electronics Association
4. Dell, Inc.
5. Globespan Virata, Inc.
6. Hewlett Packard Company
7. IEEE 802
8. Intel Corporation
9. Information Technology Industry Council
10. Itron, Inc.
10. Joint Electron Device Engineering Council
11. Motorola, Inc.
13. Nortel Networks
14. Pegasus Technologies, Inc.
15. Symbol Technologies, Inc.
16. Wi-Fi Alliance